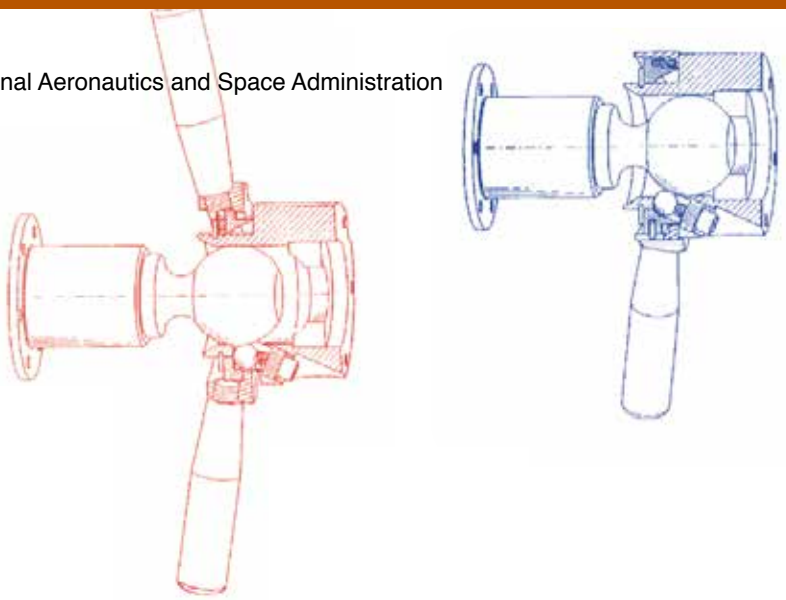
National Aeronautics and Space Administration



Mechanical and Fluid Systems

# A Better Quick-Connect Passive Capture Joint

## NASA offers companies a passive ball joint design that enables reli-able and convenient one-step locking.

**NASA's Marshall Space Flight Center** has developed a joint that employs a unique spring-loaded mechanism that automatically secures a ball hitch upon insertion into a coupler. This eliminates the need for the locking lever found in most conventional ball joints. Connections made using MSFC's quick-connect joint are easier, safer, and more reliable than those made using conventional ball joints.

## BENEFITS

- **Easy locking**—With one easy step, the quick-connect joint is fully secure. No more hassles with locking levers and safety fasteners.
- **Safe locking**—Eliminating the locking lever reduces the safety risk caused by human error and safety fastener malfunctions.
- **Easy release**—The joint can be released by pressing a lever or button, even while under load.
- **Full range of motion**—The joint allows three degrees of freedom (i.e., allows tip, tilt, and rotation).

technology solution

## THE TECHNOLOGY

Researchers at NASA Marshall Space Flight Center developed this invention to facilitate the connection of equipment in space. Researchers were unable to find a commercially available joint that would provide automatic locking while also allowing motion with three degrees of freedom. The quick-connect joint was developed in response to this need.

Simple in construction, MSFC's quick-connect joint consists of the standard ball hitch and coupler components found in conventional ball joints. The novelty in the design lies in the coupler. Conventional couplers employ a yoke that locks the ball hitch in place once the locking lever is latched. The quick-connect joint replaces the yoke and lever with a spring loaded locking ball. When the ball hitch is inserted into the coupler, the ball hitch depresses the locking ball into a recess that allows the ball hitch to slip into the coupler housing. Once the ball hitch is fully seated, the spring within the recess pushes the locking ball firmly onto the neck of the ball hitch. With the proper coupler housing design, the ball hitch is completely immobilized by the locking ball; therefore, the design does not require the use of a locking lever. Furthermore, the ball hitch is free to rotate within the coupler housing while still fixed securely within the coupler. Pressing a separate lever or button pushes the locking ball back into the recess, allowing the ball hitch to be released. NASA has developed prototypes of the quick-connect joint.

Modified designs are currently being developed for a space satellite automated docking mechanism. The docking mechanism combines a directional guide and two actuators with the basic ball joint technology to provide a practical system for docking. Automated release of the capture ball is also facilitated.

## APPLICATIONS

Manufacturers of conventional ball joints could license and incorporate MSFC's design into existing products as well as new products. The simplicity of the design enables most any company to license and develop a business based upon this quick-connect joint. This technology could be used in a wide array of applications and markets:

- Trailer hitches (fifth wheel and standard)
- Robotics
- Power trains
- Agricultural implements
- Fluid transfer systems
- Aerospace docking

## PUBLICATIONS

U.S. Patent No. 6,540,426

More Information

National Aeronautics and Space Administration

**Sammy A. Nabors**

**Marshall Space Flight Center**

Huntsville, AL 35812
256.544.5226
sammy.nabors@nasa.gov

http://technology.nasa.gov/

**www.nasa.gov**

FS-2002-03-49-MSFC

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MFS-31616-1